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February 2001 **Water Fact Sheet 2001–3**

IOWA'S WATER
Ambient Monitoring Program

Biological Assessment of Iowa's Streams and Rivers

Since 1994, the Iowa Department of Natural Resources (IDNR) and the University Hygienic Laboratory (UHL) have sampled fish and benthic macroinvertebrates to assess the biological integrity of Iowa's streams and rivers. Benthic macroinvertebrates are small animals, such as aquatic insects, crustaceans, leeches and snails that live on the stream bottom. The numbers and types of aquatic organisms are useful indicators of stream health because they reflect changes in water quality and habitat.

Sampling fish using the tow-barge electroshocker (White Fox Creek, Hamilton Co.).

Sampling

Biological sampling is done in streams and rivers throughout Iowa (Figure 1). To date, 230 sites have been sampled. There are four types of sites: **1) "Ambient" sites** are sampled annually for benthic macroinvertebrates at 16 river locations that are also monitored for water quality on a monthly basis. **2) Reference sites** represent stream conditions that are least disturbed by human activities, and are used to set biological criteria for measuring the health of other streams. The current rate of sampling is 20 sites, once per year. **3) Test sites** are sampled or "tested" to determine how much a stream's biological health is impacted by disturbances such as channelization, livestock grazing, manure spills, wastewater discharges and urban runoff. Currently, 40 sites are sampled once per year. **4) Watershed sites** are used to determine the location and

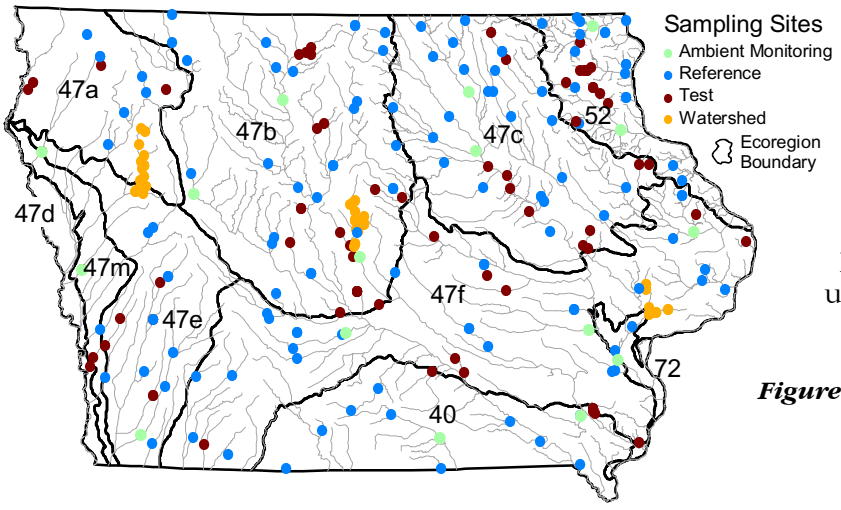

Figure 1. *1994 – 2000 biological sampling sites.*

Iowa's Stoneflies

Stoneflies (Insect Order: Plecoptera) prefer cool, oxygen-rich streams and are generally intolerant of stream pollution. Before stream biological sampling began in 1994, only 10 species of stoneflies were identified and recorded in Iowa. Aquatic biologists have since identified 22 new species in Iowa (*Neoperla clymene* is shown in photo above), increasing the stonefly species list in Iowa to 32. Sampling has been more intense in northeastern Iowa. Twenty-eight species of stoneflies are located in two ecoregions of northeastern Iowa, the Paleozoic Plateau (52) and the Iowan Surface (47c), where stream water is generally more influenced by groundwater (Figure 1). As a result, streams in northeastern Iowa generally flow clearer and cooler, which is ideal for stoneflies. As sampling continues in all regions of Iowa, more will be learned about stoneflies and other aquatic species of special interest.

amount of biological impairment in a watershed, and identify problem areas that need to be addressed. So far, 48 sites in three watersheds have been sampled. More watershed sampling is planned to support development of stream restoration plans, including TMDLs (Total Maximum Daily Loads). A TMDL is a blueprint for an impaired water body that defines the problem, identifies the source of pollutants and outlines what control methods can be implemented which will result in improved water quality so it again meets its designated uses.

Stream biological sampling is conducted from July 15 to October 15. Standard sampling procedures are used so that data from all sites are comparable. The samples measure how many types of benthic macroinvertebrates and fish are present, and the abundance of each type in relation to the whole sample. Benthic macroinvertebrates are collected from several types of habitat including aquatic vegetation, boulders, leaf packs, overhanging vegetation, rocks, root mats and woody debris. Fish are sampled in one pass through the sampling area using electrofishing gear.

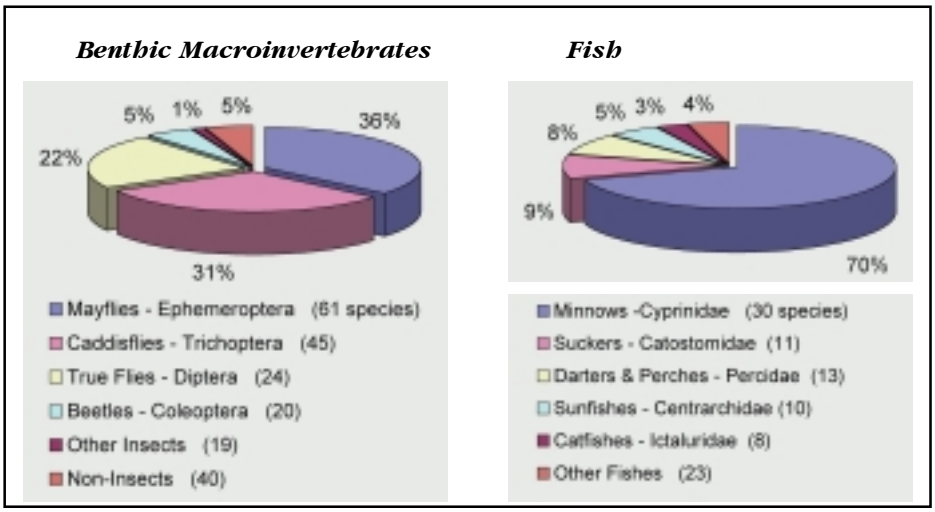

Figure 2. *Percentages of benthic macroinvertebrates in standardized samples and fish sampled from wadeable streams and rivers: 1994-1998. Number of species shown in parentheses indicates how many species within each group have been collected.*

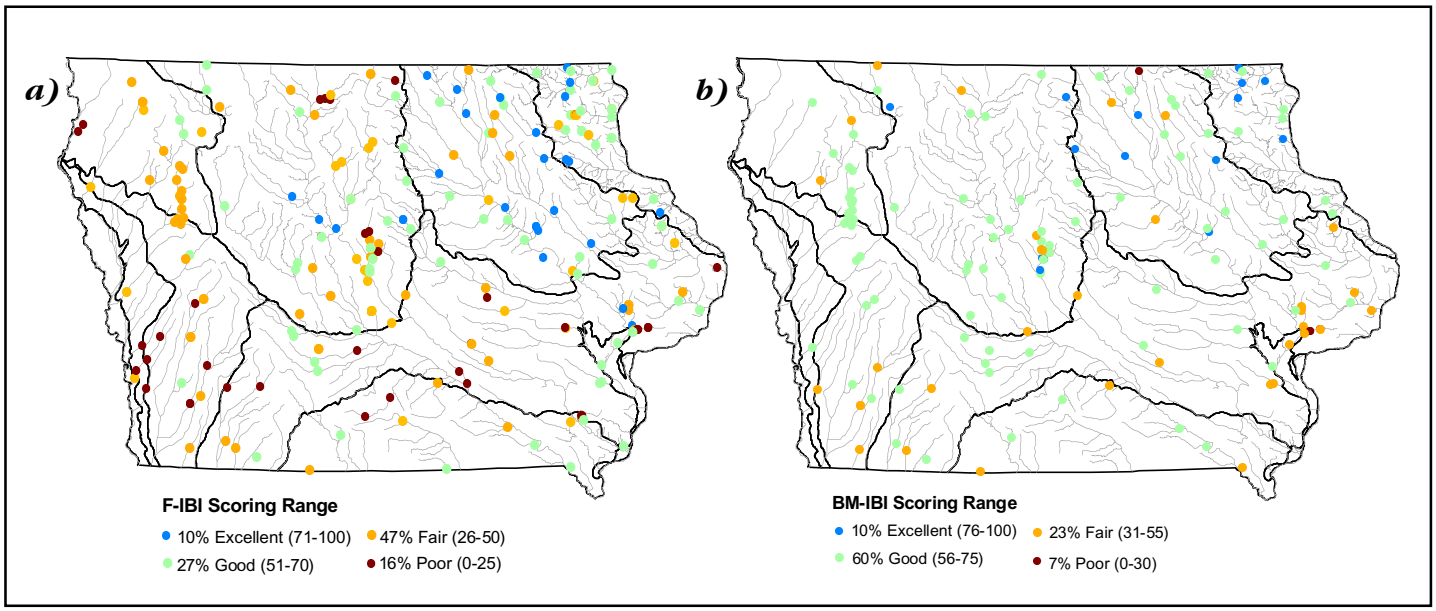

Figure 3a) *Fish Index of Biotic Integrity (F-IBI): 1994-2000;* ***b)*** *Benthic Macroinvertebrate Index of Biotic Integrity (BM-IBI):1994-1998.*

Results

Despite historical losses of many fish and freshwater mussel species, Iowa's streams still contain a sizeable amount of biological diversity. As of the year 2000, a total of 95 species of fish and approximately 350 types of benthic macroinvertebrates have been collected during this project. Aquatic insects are the most commonly sampled benthic macroinvertebrates, and minnows are the most abundant and diverse group of stream fishes sampled (Figure 2). The data help inventory aquatic species of protected status or special interest. For example, UHL biologists have documented numerous stonefly species not previously recorded in Iowa.

A Benthic Macroinvertebrate Index of Biotic Integrity (BM-IBI) and Fish Index of Biotic Integrity (F-IBI) are used to analyze sampling data. The BM-IBI and F-IBI each contain twelve measures or "metrics" that relate to species diversity, relative abundance of sensitive and tolerant organisms, and the proportion of individual organisms belonging to specific feeding and habitat groups. The metrics are scored individually and then combined to obtain an index rating from 0 (poor) to 100 (optimum). Fish index scores (F-IBI) range from 2 (poor) to 85 (excellent), with a median score of 42 (fair). F-IBI scores are generally highest in northeastern Iowa streams and lowest in southwestern Iowa streams (Figure 3a). High levels of sediment and stream channelization are two factors that negatively affect fish populations. Benthic macroinvertebrate index (BM-IBI) scores range from 15 (poor) to 90 (excellent), with a median score of 63 (good) (Figure 3b). BM-IBI scores

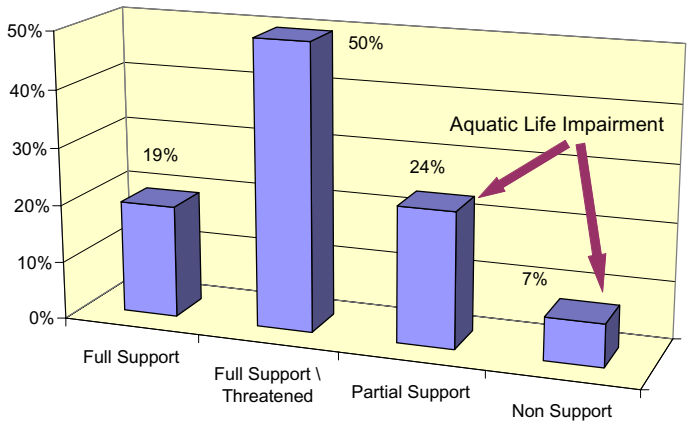

Figure 4. *Categories of stream aquatic life use attainment, determined from 1994-1998 biological assessment information.*

do not show strong regional patterns. Benthic macroinvertebrate populations appear to be more affected than fish populations by local water quality and habitat conditions.

Every two years, the IDNR reports on the status of water quality in Iowa, including the degree to which beneficial water uses are supported. Based on 1994-1998 biological sampling results, aquatic life uses (the ability to support aquatic life) were achieved at 69 percent of the stream sampling sites, and aquatic life uses were impaired at 31 percent of the sites (Figure 4). The results help the IDNR set priorities for stream restoration and TMDL development.

Acknowledgements

This project has greatly benefited from the dedication, hard work and skill of many people. The following DNR and UHL staff were involved in the project from 1994-2000: Mike Birmingham, Katie Brehm, Maggie Clover, Matt Coleman, Connie Dou, Damian Eckert, Janet Gastineau, Dennis Heimdal, Todd Hubbard, Jack Kennedy, Ken Krier, Melanie Kruse, John Miller, Jamie Mootz, Shannon Murphy, John Olson, Heidi Rantala, Mark Schneebeck, Mike Schueller, Ralph Turkle, Tom Wilton, and Seth Zimmermann.

Funding

Water monitoring activities of the Iowa Department of Natural Resources are funded by Iowa Infrastructure and State General Fund appropriations, as well as grants provided by the U.S. Environmental Protection Agency from Sections 106 and 319 of the Clean Water Act.

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Front page photos from DNR photo files; Stonefly photo by Dennis Heimdal, UHL

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